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09/976,624	10/12/2001	Werner Juengling	MI22-1789	2304

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EXAMINER

KIELIN, ERIK J

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 03/19/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/976,624

Applicant(s)

JUENGLING ET AL.

Examiner

Erik Kielin

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 30 December 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 105,111-114 and 130 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 105,111-114 and 130 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 10.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims **105**, 112, 113, and 130 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,744,399 (**Rostoker et al.**) in view of US 4,843,034 (**Herndon et al.**).

Regarding claim 105, **Rostoker** discloses a method of forming a material adjacent a conductive electrical component or between a pair of conductive lines --as further limited by instant claim 113-- comprising:

providing the conductive electrical component **10** over a substrate **7** (col. 1, lines 28-30; col. 3, lines 6-12);

providing a mass **20** (Fig. 2) having pores of a size (Fig. 1A; col. 2, lines 54-59) adjacent the conductive component **10**, wherein the mass has a matrix forming material comprising silicon (SiO<sub>2</sub>; col. 3, line 38-42) with fullerene (porous carbon molecules containing 32 to 960 carbon atoms; col. 3, lines 46-52) dispersed throughout, and where the mass is applied by spinning on the matrix material with the fullerene dispersed therein (paragraph bridging cols. 4-5); and

vaporizing the portion into a mass **24** (Fig. 4, col. 6, lines 41-47), wherein the vaporizing expands the size of the pores (Figs. 1B-1D; col. 2, line 62 to col. 3, line 5), wherein the vaporizing is carried out using oxygen plasma or ozone (column 7, lines 20-49); and

Art Unit: 2813

forming a layer of an insulative material **40** overlying the mass, after the vaporization step (column 6, lines 10-20, 40-45), as further limited by instant claim 112.

**Rostoker** does not indicate that the mass may comprise molecules consisting of silicon and carbon. **Rostoker** does, however, indicate that the mass may comprising a non-limiting list including silicon oxide, silicon nitride, aluminum oxide undoped silicon, and polyimide (col. 3, lines 28-43).

**Herndon** also teaches a method of forming an insulating mass **I2** adjacent a conductive electrical component or between a pair of conductive lines **M1**, wherein the material may be silicon carbide, silicon nitride, silicon oxide, aluminum oxide, and polyimide (Fig. 2A; paragraph bridging cols. 3-4).

It would have been obvious for one of ordinary skill in the art, at the time of the invention to use silicon carbide as the matrix-forming, insulating mass in **Rostoker** because **Rostoker** indicates that other insulating materials than those indicated above may be used for the matrix-forming mass and because **Herndon** teaches an almost identical list of insulating materials for the same purpose of electrically insulating conductive lines on a semiconductor substrate, thereby indicating that silicon carbide is known, long before the invention of **Rostoker**, for the purpose of electrical insulation between conductive lines.

In this regard, note it has been held that the selection of a known material based on its suitability for its intended use is *prima facie* obvious. The selection of a known material based on its suitability for its intended use supported a *prima facie* obviousness determination in *Sinclair & Carroll Co., Inc. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945) (Claims to a printing ink comprising a solvent having the vapor pressure characteristics of butyl carbitol so

Art Unit: 2813

that the ink would not dry at room temperature but would dry quickly upon heating were held invalid over a reference teaching a printing ink made with a different solvent that was nonvolatile at room temperature but highly volatile when heated in view of an article which taught the desired boiling point and vapor pressure characteristics of a solvent for printing inks and a catalog teaching the boiling point and vapor pressure characteristics of butyl carbitol. "Reading a list and selecting a known compound to meet known requirements is no more ingenious than selecting the last piece to put in the last opening in a jig - saw puzzle." 65 USPQ at 301.). See also *In re LESHIN*, 125 USPQ 416 (CCPA 1960) ("Mere selection of known plastics to make container-dispenser of a type made of plastics prior to the invention, the selection of the plastics being on the basis of suitability for the intended use, would be entirely obvious; and in view of 35 U.S.C. 103 it is a wonder that the point is even mentioned.") (See MPEP 2144.07.)

Regarding claim 130, silicon carbide is molecularly denoted as  $\text{SiC}_x$ .

3. Claim 111 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Rostoker** in view of **Herndon** as applied to claim 105 above, and further in view of US 5,494,858 (**Gnade et al.**).

**Rostoker** does not teach "forming a layer over the mass **before** partially vaporizing" (emphasis added).

**Gnade** teaches a method of forming a porous dielectric layer **28** between conductive lines. **Gnade** also teaches that a layer 26 (Fig. 1C) may be formed before evaporating a portion of the mass to increase the size of the pores (Fig. 1D).

It would have been obvious for one of ordinary skill in the art, at the time of the invention to modify **Rostoker** in view of **Gnade** to partially vaporize after forming the layer over the mass because it appears that forming the layer over the mass before vaporizing would work just as well as forming it after vaporizing. Further the selection of any order of performing process steps is prima facie obvious in the absence of new or unexpected results. (See MPEP 2144.04.) In the instant case, the same result is obtained in **Gnade** and **Rostoker**, i.e. a porous dielectric layer with a layer overlying the porous layer whether the layer is formed before or after the vaporization step. Moreover, the instant specification teaches away from any criticality to the order of steps since it is disclosed and claimed that the vaporizing of the mass may occur either before or after forming “the layer” with equal results.

4. Claim 114 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Rostoker** in view of **Herndon** as applied to claims 105 and 113 above, and further in view of either of **Matthews** (US 5,171,713) and **TeVelde** (US 4,561,173)..

**Rostoker** does not teach support member between the pair of conductive metal lines.

Each of **Matthews** (US 5,171,713; Fig. 23B, 26B, pedestal **102** between conductive features **98** and **99**) and **TeVelde** (US 4,561,173; col. 5, lines 16-26; cover Fig., item **12** between conductive features **3-5, 10**) teach support structures used in air gaps to provide the needed support between metallization structures.

It would have been obvious for one of ordinary skill in the art, at the time of the invention to apply the support structures of either of **Matthews** and **TeVelde**, to the invention of **Rostoker**, to provide necessary support where support is needed, as between metallization

Art Unit: 2813

structures, which are not close enough together to provide the needed support, as taught by **Matthew** and **TeVelde**.

Note in pertinent part that **Rostoker** indicates that the dielectric layer may be fragile and therefore in need of support due to the presence of overlying layers. (See also col. 5, lines 25-39.) One of ordinary skill would be motivated to use the support structures, additionally, because the dielectric in **Rostoker** could be made of even lower dielectric constant by incorporating even more pores. Such increase in pores, while lowering the dielectric constant, would also make the porous dielectric layer more fragile and consequently in need of such support members, but would also desirably result in reducing, further, the RC delay.

Should Applicant think that **Matthews** and **TeVelde** are not appropriate for the instant invention because of the method used to form the “support structures.” Applicant is referred to the instant specification, page 14, lines 5-6, wherein it is stated, “Support members 38 can be formed by methods **readily apparent to persons of ordinary skill in the art.**” (Emphasis added.) Therefore, all that is required of the inventions of either of **Matthews** and **TeVelde** is that they suggest the use of such support structure.

### *Response to Arguments*

5. Applicant's arguments with respect to claims 105 and 111-114 have been considered but are moot in view of the new ground(s) of rejection.

### *Conclusion*

Art Unit: 2813

6. This action is made non-final to give Applicant the opportunity to respond to the new ground of rejection.

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

US 5,858,871 (**Jeng**) discloses forming a porous dielectric 20 between conductive metal lines 14a, 14b, 14c and then vaporizing to expand the size of the pores (paragraph bridging cols. 7-80).

US 5,461,003 (**Havemann et al.**), US 5,488,015 (**Havemann et al.**), US 5,723,368 (**Cho et al.**), US 5,750,415 (**Gnade et al.**), US 6,319,852 B1 (**Smith et al.**) each teaches methods of forming porous masses between conductive lines wherein the mass comprises molecules comprising silicon and carbon.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erik Kielin whose telephone number is 703-306-5980. The examiner can normally be reached on 9:00 - 19:30 on Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached at 703-308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

  
Erik Kielin

March 15, 2003